

Citation:

Takata Y, Ansai T, Soh I, Akifusa S, Sonoki K, Fujisawa K, Awano S, Kagiya S, Hamasaki T, Nakamichi I, Yoshida A, Takehara T. Association between body mass index and mortality in an 80-year-old-population. *J Am Geriatr Soc*. 2007 Jun;55(6):913-7.

PubMed ID: [17537093](#)

Study Design:

Cohort Study

Class:

B - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To evaluate the association between body mass index (BMI) and all-cause mortality and cardiovascular (CVD) in an 80-year old population.

Inclusion Criteria:

- The candidates for participation in the study were 1282 individuals who were born in 1917 and who were 80 years old at the time the study was conducted.
- Subjects with cancer, severe cardiopulmonary disease, or short life expectancy were not excluded from participation.
- The study was conducted according to the principles expressed in the Declaration of Helsinki and approved by the human ethics committee of Kyushu Dental College.
- The details of the study protocol were explained to the subjects, and informed consent was obtained before participation.

Exclusion Criteria:

Exclusion criteria were not delineated.

Description of Study Protocol:

Recruitment : Details were not provided.

Design : Cohort study

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis

- All data were reported as mean \pm standard deviation.
- Differences in mean values between groups were assessed using analysis of variance.
- Categorical variables were compared using the chi-square (χ^2) tests.
- Association between BMI [body weight (kg)/height (m)²] and time to 4-year mortality were assessed using the multivariate Cox proportional hazards regression model, in which sex (male/female), tobacco use (current smoker/noncurrent smoker), alcohol use (drinker/nondrinker), weight loss during the year study based on self report (yes/no), current outpatient status (yes/no), systolic blood pressure (SBP), physical activity, functional status, marital status and levels of total serum cholesterol and glucose were adjusted as confounding factors.
- Preexisting diseases such as respiratory diseases (e.g., pneumonia, bronchial asthma, bronchiectasia, emphysema, pneumothorax, pulmonary tuberculosis, and pneumoconiosis), CVD (e.g., cerebrovascular diseases, IHD, arrhythmias, and congenital heart disease), and cancer (e.g., gastrointestinal system, liver/bile duct/pancreatic system, brain, uterus, ovary, and nephro-urinary system) were also adjusted as confounding factors in the analysis.
- Place of residence was included as a proxy for adjustment.
- The Kaplan-Meier method was also used to estimate cumulative survival in the three BMI groups (overweight, underweight, and normal weight, followed by a log-rank test to assess the significance of differences between survival curves.
- All statistical analyses were performed using Stat-View 5.0 (SAS Institute, Inc., Cary, NC).
- Results were considered to be statistically significant at $P < .05$.

Data Collection Summary:

Timing of Measurements

- All participants underwent a physical examination and a laboratory blood examination, although body weight and height measurements were not taken for 20 participants.
- The dates and causes of all deaths were followed up for 4 years.

Dependent Variables

- Mortality
 - The dates and causes of death were recorded based resident registration card and official death certificates. The cause of death was classified according to the International Classification of diseases, Tenth Revision.
 - Overall: cardiovascular, cancer, pneumonia
 - Cardiovascular: cerebrovascular diseases, IHD, arrhythmias, and congenital heart disease
 - Cancer: gastrointestinal system, liver/bile duct/pancreatic system, brain, uterus, ovary, and nephro-urinary system
 - Pneumonia: respiratory diseases (e.g., pneumonia, bronchial asthma, bronchiectasia, emphysema, pneumothorax, pulmonary tuberculosis, and pneumoconiosis)

Independent Variables

- BMI, kg/m²
 - Underweight = < 18.5
 - Normal weight = $18.5 - 24.9$

- Overweight = ≥ 25.0

Control Variables

- Sex (male/female)
- Total cholesterol, mg/dL
- Serum glucose, mg/dL
- Systolic blood pressure, mmHg
- Weight loss during the year before the study based on self report (yes/no)
- Current out patient status (yes/no). Current outpatient status, which may be associated with a greater prevalence of complicated diseases, referred to an individual who visited a hospital regularly for treatment.
- Alcohol use (drinker/nondrinker)
- Tobacco use (current smoker/non smoker)

Description of Actual Data Sample:

Initial N:

- Of the 1,282 eligible individuals, 697(54.4%; 277 men and 420 women) agreed to participate.

Attrition (final N): as above

Age: 80 years

Ethnicity: Japanese

Other relevant demographics:

Anthropometrics

Location: Kitakyushu, Japan

Summary of Results:

Key Findings

- The relative hazard ratios (HRs) for all-cause mortality were lower in the overweight subjects ($BMI \geq 25.0$) than in the underweight ($BMI < 18.5$) or normal-weight ($BMI 18.5-24.9$) subjects.
- Similarly, the HRs for mortality due to CVD in overweight subjects were 78% less ($HR=0.22$, 95% confidence interval =0.06-0.77) than those in the underweight subjects, and those in the normal weight subjects were 78% less ($HR=0.22$, 95% CI=0.08-0.60) than those in underweight subjects.
- Mortality due to CVD was 4.6 times ($HR 4.64$, 95% CI= 1.68-12.80) as high in underweight subjects as in normal weight subjects, and mortality due to cancers were 88% lower ($HR=0.12$, 95% CI=0.02-0.78) in overweight group than in underweight group.
- There were no differences in mortality due to pneumonia.

Table 1. Baseline Characteristics of Individuals at Age 80, According to Body Mass Index (BMI) at the Start of 4-Year

Follow-up Period

	BMI			
Characteristics	<18.5(n=52)	18.5-24.9(n=468)	≥25.0(n=155)	P-value
Men/women (men, %)	17/35(32.7)	192/276(41.0)	56/99(36.1)	.33
Total cholesterol, mg/dL.	199.9±36.4	204.6±38.2	210.3±36.4	.15
Serum glucose, mg/dL.	120.3±51.8	121.1±52.2	123.7±48.0	
Systolic blood pressure, mmHg	145.7±24.5	149.2±23.1	156.0±22.3	.003
BMI,kg/m ²	17.2±0.9	21.8±1.7	27.3±2.1	<.001
Weight loss, %	20.0	18.7	7.2	.003
Current outpatient,%	84.3	84.0	83.1	.96
Drinkers,%	66.7	55.7	54.4	.30
Smokers, %	24.0	12.7	11.1	.06

Table 2.Mortality According to Body Mass Index (BMI)

	BMI			
	<18.5(n=52)	18.5-24.9(n=468)	≥25.0(n=155)	
Cause of Mortality	%			P-value
Overall	25.0	16.0	7.7	.005
Cardiovascular	11.5	2.8	3.9	.007
Cancer	7.7	4.1	1.9	.16
Pneumonia	3.8	3.2	1.3	.41

Table 3. Mortality According to Weight Change

Cause of Mortality	Weight Loss (n=110)	No Change (n=512)	Weight Gain (n=64)	P-value
Overall	21.8	14.8	10.9	.10
Cardiovascular	4.5	3.5	6.3	.53
Cancer	5.5	4.1	0.0	.19
Pneumonia	3.6	3.3	0.0	.32

Table 4. Multivariate Cox Analyses of Body Mass Index (BMI) and Mortality

Mortality/BMI	Hazard Ratio(95% Confidence Interval)		
Overall			
<18.5	1.00	1.94(1.00-3.760)	3.95(1.63-9.54)†
18.5-24.9	0.52(0.27-1.00)	1.00	2.21(1.07-4.57)*
≥25.0	0.25(0.10-0.60)†	0.48(0.24-0.96)*	1.00
Cardiovascular disease			
<18.5	1.00	4.64(1.68-12.08)†	3.45(1.00-11.87)*
18.5-24.9	0.22(0.08-0.60)†	1.000	0.92(0.32-2.67)
≥25.0	0.22(0.60-0.77)*	1.02(0.35-2.95)	1.00

Pneumonia			
<18.5	1.00	1.45(0.17-12.45)	3.59(0.20-63.60)
18.5-24.9	0.69(0.08-5.94)	1.000	3.08(0.34-28.01)
≥25.0	0.21(0.01-3.70)	0.31(0.03-2.77)	1.00
Cancer			
<18.5	1.00	2.17(0.60-7.85)	17.69(1.83-171.03)*
18.5-24.9	0.46(0.13-1.64)	1.00	7.64(0.96-61.07)
≥25.0	0.12(0.02-0.78)*	0.26(0.06-1.20)	1.00

Note: Adjusted for sex, current outpatient status, smoking, drinking, weight loss, systolic blood pressure, physical activity, functional status, marital status, preexisting diseases, place of residence, and levels of total serum cholesterol and glucose.
P<*.05; †.01.

Author Conclusion:

Overweight status was associated with longevity and underweight group than in the underweight with short life, due to lower and higher mortality respectively, from CVD and cancer.

Reviewer Comments:

Recruitment methods not described. Body weight and height measurements were not taken for 20 participants. Only 4 years of follow-up. Authors note the following:

- *It is important to remember that the present study had certain limitations; socioeconomic status was not included as confounding factor, and although it was attempted to adjust for comorbid conditions, it is possible that residual confounding by preexisting disease remained.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

- | | | |
|----|---|-----|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | N/A |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | N/A |

Validity Questions

1.	Was the research question clearly stated?	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	Was the selection of study subjects/patients free from bias?	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	Were study groups comparable?	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes

4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes

7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	Are conclusions supported by results with biases and limitations taken into consideration?	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	Is bias due to study's funding or sponsorship unlikely?	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

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